A GUIDE FOR THE PROSPECTIVE LICENSED AIRCRAFT MAINTENANCE ENGINEER

Published by The Society of Licensed Aircraft Engineers and Technologists

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PRICE: TWELVE SHILLINGS AND SIXPENCE

The Society of Licensed Aircraft Engineers and Technologists,
Mark House,
153 *London Road,*
Kingston-upon-Thames,
Surrey.

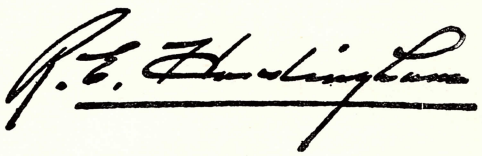
First Edition, January, 1947
Second Edition, April, 1947
Third Edition, September, 1949
Fourth Edition, October, 1957
Fifth Edition, February, 1966

FOREWORD

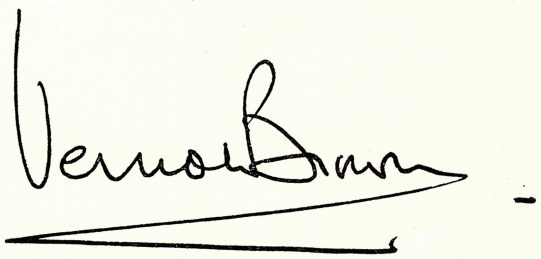
The Air Registration Board and the Society of Licensed Aircraft Engineers and Technologists appreciate the difficulties with which the prospective licensed aircraft engineer is faced. He must not only have the knowledge necessary to equip him for his important job, but he must also demonstrate this knowledge to the Board's examiners. It is not always easy for a man to do this when he is unaccustomed to expressing his knowledge of the subject by the written or spoken word.

This booklet is intended to help a candidate over these difficulties. All the information it contains relating to the Board's examinations has been checked by the Board and the Society. A chapter on the Society's own examinations is included and it is worth noting that the Society's Technical Certificate not only provides some exemptions from the Board's Examinations but is now also accepted by the Corporations and some of the Independent Airlines as a qualification for entry into and promotion within certain aircraft engineering grades.

The Guide should encourage every aircraft engineer to improve his standard of knowledge and help those who are not already licensed to obtain this valuable qualification.



Chief Executive,
Air Registration Board.



Chairman, Central Examining Authority,
Society of Licensed Aircraft Engineers
and Technologists.

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Chapter I

INTRODUCTION

History

When World War I ended and the aeroplane was first used for commercial purposes, it was found necessary, in the interests of public safety, to exercise some authoritative control. The Air Navigation Act of 1920 made the issue of regulations and requirements governing the design, construction and maintenance of aircraft registered in the United Kingdom the responsibility of the Secretary of State for Air. Within the Air Ministry, a Department of Civil Aviation was established and this department published the necessary regulations as Statutory Instruments. The responsibility for ensuring the satisfactory construction of civil aircraft was originally vested in a branch of the Aeronautical Inspection Directorate (A.I.D.), but after the passing of the Air Navigation Act of 1936, these duties were delegated to the Air Registration Board.

The Air Registration Board was established in 1937 and in 1938 the Secretary of State made it responsible for examining applicants for Engineers' Licences. Engineers' Licences, the holders of which were originally known as "Ground Engineers", had been issued to engineers on the recommendation of the A.I.D. for many years previous to this date. Licensed Engineers are inspectors who exercise delegated authority to make certifications in respect of aircraft maintenance, overhaul, modification, replacement, repair and inspection according to the terms of their licences. A number, to be quoted when signing a certification, is allotted to each Licence.

Current Legislation and Requirements

The licensed aircraft engineer is required to be conversant with those parts of current legislation and requirements which affect his duties. In this respect it is important, in the first instance, to appreciate the difference between legislation (i.e. Statutory Instruments such as the Air Navigation Order) and requirements (i.e. British Civil Airworthiness Requirements).

Statutory Instruments are laid before Parliament and are approved by The Queen's Most Excellent Majesty in Council before promulgation. In this context Statutory Instruments constitute the law of the land relating to civil aircraft, as provided by the Civil Aviation Act of 1949.

Part II of the Air Navigation Order, 1960, deals with Airworthiness and Equipment of Aircraft and it is this part of the Order with which the Air Registration Board (A.R.B.) is particularly concerned. By means of the powers provided by the Civil Aviation (Air Registration Board) Order, 1960, the Minister of Aviation has delegated to the A.R.B. the responsibility for the formulation and publication of requirements in respect of the matters to which Part II of the Air Navigation Order relates, and for the investigation of the extent to which those requirements are complied with either generally or in a particular case.

Note: The Civil Aviation (Air Registration Board) Order also empowers the Minister to delegate other functions to the A.R.B., including the grant, validation, renewal and variation (including ratings) of Aircraft Maintenance Engineers' Licences.

Article 4(1) of Part II of the Air Navigation Order, 1960, prescribes (with certain reservations) that "An aircraft shall not fly unless there is in force in respect thereof a certificate of airworthiness duly issued under the law of the country in which the aircraft is registered, and any conditions subject to which the certificate was issued are complied with". Thus the Article establishes

in law that a certificate of airworthiness must be in force before an aircraft can fly but prescribes no details as to how such a certificate can be obtained. The necessary details are prescribed by the A.R.B. in their publication British Civil Airworthiness Requirements (B.C.A.R.).

B.C.A.R. consists of eight sections, as follows: Section A—General Information and Procedure; Section C—Engines and Propellers; Section D—Aeroplanes; Section E—Gliders; Section G—Rotorcraft; Section J—Electrical; Section L—Licensing and Section R—Radio. As the title of Section A implies, all other sections of B.C.A.R. should be read in conjunction with this section.

Section L deals with the requirements for Aircraft Maintenance Engineers' Licences and details the syllabus of the examination for the various categories of licence. It also outlines the practical experience required of the applicant. The latter must be reflected in a Schedule of Inspection Work to which reference is made in the appendix to Section L.

In addition to B.C.A.R., the A.R.B. issues other publications relevant to the engineer's studies. Information about the A.R.B. publications with which the engineer should be conversant is given in the appendix to this booklet.

The essence of the system of airworthiness control by the A.R.B. in conjunction with approved organisations and licensed aircraft engineers is as follows: the A.R.B. prescribes airworthiness requirements and approves organisations and licenses aircraft engineers, to both of whom may be further delegated some of the responsibilities for ensuring that these requirements are complied with in practice.

Supervision is carried out by the technical staff of the A.R.B., all of whom are known as "Surveyors" whether they work on Design or Power Plant investigations or on Inspection Duties in the fields of construction and operation. Certain Surveyors deal with specialist activities on electrics, instruments, radio, flight testing and so on. Surveyors are allocated to various areas according to the amount of aviation activity and are responsible to their Head Office for the work in their area.

Duties

Details of certifications that may be made by Licensed Aircraft Engineers are given in Chapter III of this booklet. The A.R.B. Requirements for the grant and extension of licences are intended to ensure that only responsible engineers with an adequate knowledge of the aircraft or engine concerned are authorised to make such certifications. The United Kingdom Requirements for Licences concur with the standards recommended by the International Civil Aviation Organisation (I.C.A.O.) for Aircraft Maintenance Engineers' Licences.

Aircraft Radio Maintenance Engineers' Licences, which are issued by the Ministry of Aviation and not by the A.R.B., are not included in Section L.

It is not necessary for every engineer employed on work in connection with civil aircraft to be licensed, but it is essential that every organisation concerned with the operation of aircraft should have a quota of licence holders in order that mandatory certifications may be made.

The licence is an authority to certify that any work done on an aircraft or engine has been executed in accordance with the Board's requirements. A licence holder may, of course, act in a dual capacity—he can be both the man doing the work and the man inspecting it. This sometimes makes his position difficult and it should be clearly understood that when the work is finished and he inspects and certifies it, he is at that point acting under the authority granted to him by the A.R.B. on behalf of the Minister of Aviation.

A licence holder's position while acting in this capacity is one of responsibility since the safety of the aircraft depends on the quality of his inspection and the integrity of his certification. If at any time he fails to use properly the powers that have been given to him, or if he

certifies anything which he is not authorised by the terms of his licence to certify, his licence may be cancelled or suspended.

The purpose of this booklet is to summarise and explain the requirements governing the examinations for Aircraft Maintenance Engineers' Licences, to give guidance on the form of the examination and to assist applicants in interpreting the examination syllabus. The booklet is framed to give intending applicants for licences a clear picture of how to obtain a licence and the duties they will subsequently perform.

Chapter II

CATEGORIES OF LICENCES

The responsibilities of the aircraft maintenance engineer in the certification of aircraft are defined in A.R.B. Notice No. 3, which is amended as is necessary from time to time. The categories of aircraft and engines and specialised equipment, covered by licences and ratings for which the licence holder is authorised, are contained in A.R.B. Notice No. 10, which is amended as the need arises by the introduction of new types and new circumstances or conditions.

It follows, for example, that the holder of a licence on light aircraft or piston engines could not certify larger aircraft or turbine engines unless he was also licensed on these types.

As in many cases certification will involve several engineers and an overlap of responsibility may occur, it is important that the holder of a licence in a specified category should be conversant with the duties of other engineers.

Aircraft

Category "A"—Aeroplanes Licences in Category "A" are granted for the types listed in paragraph 5 of A.R.B. Notice No. 10.

Category "B"—Aircraft, including Rotorcraft A Category "B" licence is effectively an extension of a Category "A" licence which entitles the holder to carry out further certification as detailed in paragraph 3 of A.R.B. Notice No. 3.

Licences in Category "B" are granted for the types listed in paragraphs 5 and 7 of A.R.B. Notice No. 10.

The A.R.B. does not grant Category "B" licences for certification of the very large and complex aircraft listed in paragraphs 5 and 7 of A.R.B. Notice No. 10. These may be certified only under the authority of an appropriately approved inspection organisation.

Categories "A" and "C"—Rotorcraft Combined licences *only* are granted for rotorcraft. The types are listed in paragraph 7 of A.R.B. Notice No. 10.

A Category "C" licence granted for engines in fixed wing aircraft cannot be used to certify rotorcraft engines.

Engines

Categories "C" and "D"—Engines Licences in Categories "C" and "D" are granted for the types listed in paragraph 6 of A.R.B. Notice No. 10.

Note 1: The A.R.B. does not grant licences in Category "D" for certification of the very large and complex engines listed in paragraph 6.3 of A.R.B. Notice No. 10. These may be certified only under the authority of an appropriately approved organisation.

Note 2: Applications will not be considered for Category "D" in respect of gas turbine engines of any type.

Note 3: A licence in Category "C" to cover the certification of an engine in a rotorcraft will not be issued except in conjunction with a licence in Category "A" covering that type of rotorcraft.

Instruments and Equipment

Category "X"—Compasses Licences are granted for direct-reading magnetic compasses and for specific types of remote-reading compasses.

Category "X"—Instruments Licences are granted for the aircraft types listed in paragraph 8 of A.R.B. Notice No. 10.

Category "X"—Electrical Licences are granted for the aircraft types listed in paragraph 9 of A.R.B. Notice No. 10.

Category "X"—Automatic Pilots Licences are granted for specific types of automatic pilots.

Multi-Category "X"—Instruments, Automatic Pilots and Compasses Licences are granted for specific aircraft types as detailed in paragraph 10 of A.R.B. Notice No. 10.

Radio

Aircraft Radio Maintenance Engineers' Licences are not issued by the A.R.B. The syllabus for the examination is given in a booklet entitled "Aircraft Radio Maintenance Engineers' Licences" (C.A.P.101), obtainable from Her Majesty's Stationery Office. Additional details may be obtained from the Ministry of Aviation, Department TELS 03, 19-29 Woburn Place, London, W.C.1.

Gliders

The maintenance, overhaul and repair of most gliders in the United Kingdom is controlled by a scheme administrated by the British Gliding Association (B.G.A.), under authority derived from the Ministry of Aviation. The B.G.A. examine and authorise engineers for the purpose of certification of the gliders operated under B.G.A. airworthiness arrangements. Consequently very few Aircraft Maintenance Engineers' Licences have been issued in respect of the glider rating in Categories "A" and "B".

Chapter III

DUTIES OF LICENSED ENGINEERS

Introduction

The primary duty of all licensed engineers is to certify, within the terms of their licences, that all work has been carried out in accordance with the requirements of the Airworthiness Authority. As proof that this function has been carried out, and to provide proper documentation, it is required that various certificates shall be signed by a licensed engineer.

Certification responsibilities are defined in A.R.B. Notice No. 3, and the categories and ratings of the licence(s) required are detailed in A.R.B. Notice No. 10. These Notices and the documents to which they refer should be read in conjunction with this chapter.

The following paragraphs outline the main certification responsibilities of Licensed Aircraft Maintenance Engineers and therefore the duties they are likely to perform.

General

For the purpose of certification the following items are defined by the A.R.B.

Overhaul An overhaul is a major work operation which involves dismantling, bench testing and renewal of operational life. Servicing of items such as piston engine sparking plugs is not considered to constitute overhaul; neither is "top overhaul" of a piston engine. The complete work concerned with renewal of a Certificate of Airworthiness does not necessarily constitute overhaul and each work operation must be considered individually. Whenever doubt exists reference should be made to the A.R.B.

Modification A modification is any work which is identified by a modification reference on a Form A.R.B. 261, a modification number, or in the case of foreign-built aircraft, by an equivalent identification system.

Replacement A replacement is a work operation which involves the removal and replacement of the same part or the substitution of another similar part. The opening and closing of inspection covers, access hatches, exits, cowlings, etc., is not considered to constitute replacement.

Repair A repair is any work relating to rectification which does not come under one of the above headings.

Inspection The physical act of inspecting is part of any work which constitutes overhaul, modification, replacement or repair and such inspection is covered by the certification required for the work.

Where the work is the inspection itself, such inspections requiring certification are indicated by the A.R.B. These include inspections summarised in the A.R.B. publication "Mandatory Aircraft Modifications and Inspection Summary".

When any work involves a flying control system or an engine control system, duplicate inspections are required (as stipulated in Chapter A5—3 of B.C.A.R.), and both inspections must be certificated before the relevant certificate of compliance is issued.

A duplicate inspection is an inspection which is first made and certificated by one person and is then repeated by another person and again certificated. The relevant certificate in this case is the Certificate of Compliance which may only be signed by appropriately licensed engineers or by members of an organisation approved by the A.R.B. for the purpose.

Certificate of Final Inspection for Fitness for Flight

A certificate of inspection for fitness for flight is part of the Civil Aircraft Inspection Record which is kept by the A.R.B. for the aircraft concerned (Form A.R.B. 268). It must be signed by engineers licensed in Categories "A" and "C" in respect of the type of aircraft and engines concerned or, in the case of an Approved Inspection Organisation, by members of the Inspection staff authorised by the Chief Inspector.

The certificate is in the form shown in Figure 1.

In the case of prototype aircraft, the Certificate of Final Inspection for Fitness for Flight is signed by a Surveyor of the A.R.B.

The certificate is required to enable aircraft to be tested in flight (see Chapter A5—2 of B.C.A.R.) to schedules approved by the A.R.B. for the issue of a Certificate of Airworthiness for a new aircraft such as a prototype or series aircraft as defined in Section A of B.C.A.R., or for the renewal of a Certificate of Airworthiness.

Responsibilities of engineers for certificates of fitness for flight under the "A" conditions are specified in the Second Schedule of the Air Navigation Order.

Certificate of Maintenance

An aircraft registered in the United Kingdom must not fly for the purposes of public transport or dropping or projecting any material for agricultural, public health or similar purposes, unless the aircraft, together with its equipment and radio station, is maintained in accordance with Maintenance Schedules approved for that aircraft and that a valid Certificate of Maintenance is in force certifying that the aircraft has been main-

Registration Marks..... Constructor's No.....

CERTIFICATE OF FINAL INSPECTION
FOR FITNESS FOR FLIGHT

I
WE hereby certify that the aircraft defined herein has been inspected and in the opinion of the undersigned it is safe this day in every way for flight provided it is properly loaded.

Signed..... Date.....

*A.R.B. Inspection Approval No.....

*Licence No. (Cat. "A").....

Signed..... Date.....

*A.R.B. Inspection Approval No.....

*Licence No. (Cat. "C").....

*Delete whichever is inapplicable.

FIGURE 1.

tained in accordance with the approved Maintenance Schedule.

Note: Maintenance Schedules are approved by the A.R.B. under the authority delegated to it by the Minister of Aviation, and the A.R.B.'s requirements in respect of Maintenance Schedules are prescribed in Chapter A6—4 of B.C.A.R.

The Certificate of Maintenance must be issued at the periods stated in the approved Maintenance Schedule. The Certificate comes into force immediately after issue and ceases to be in force when a new certificate is required to be issued by the terms of the Maintenance Schedule.

The form of the Certificate of Maintenance is shown in Figure 2.

A Certificate of Maintenance may be issued only by the following :—

1. The holder of an appropriate aircraft maintenance engineer's licence or aircraft radio maintenance engineer's licence.

2. A person authorised by the Minister of Aviation to issue a certificate in a particular case.

The Certificate of Maintenance must be signed by the categories of engineers specified in the approval letter of the Maintenance Schedule for the particular checks detailed in the schedule.

The period of validity of a Certificate of Maintenance is recorded on it and the number of hours which the aircraft has flown since its issue must be recorded.

CERTIFICATE OF MAINTENANCE

Aircraft Type..... Nationality and Registration Marks.....

Check completed prior to issue.....

I

WE hereby certify that the above aircraft has been maintained and inspected in accordance with the approved maintenance schedule.

Category	Licence No.	Signature	Date
"A" (Radio)	.....	.....	.....
"X" (Automatic Pilots)	.....	.....	.....
"X" (Compasses) ..	.....	.....	.....
"X" (Instruments) ..	.....	.....	.....
"X" (Electrical) ..	.....	.....	.....
"C" (Engines).. ..	.....	.....	.....
"A" (Aircraft) ..	.....	.....	.....

Period of validity..... days or upon completion by the aircraft of..... flying hours from the date of certification, whichever is the sooner.

FIGURE 2.

Before issuing a Certificate of Maintenance, licensed engineers should satisfy themselves that, on the basis of the information provided by the operator up to the time of issue of the Certificate, all maintenance and inspections required to be carried out in accordance with approved Maintenance Schedules have been so carried out and that all recorded defects have been rectified and properly certificated by means of a Certificate of Compliance.

Certificates of Maintenance should be issued in duplicate, one copy being carried in the aircraft Technical Log during its period of validity, the other being kept elsewhere than in the aircraft and should be preserved for a period of two years after its period of validity.

Certificate of Compliance

An aircraft in respect of which a Certificate of Airworthiness is in force must not fly if any part of the aircraft or such of its equipment as is necessary for the airworthiness of the aircraft has been inspected, overhauled, repaired, replaced or modified unless there is in force a Certificate of Compliance relating to the inspection, overhaul, repair, replacement or modification, as the case may be.

A Certificate of Compliance means a certificate that the part of the aircraft or its equipment has been inspected, overhauled, repaired, replaced or modified, as the case may be, in a manner and with material of a type approved by the A.R.B., that this has been done in accordance with the requirements of the A.R.B.

The licensed engineer should ensure that all materials, components and replacements used are suitably released by Approved Certificates bearing an A.R.B. Authority Reference Number.

The A.R.B. Requirements regarding the issue of a Certificate of Compliance are prescribed in Chapter A4—3 of B.C.A.R. The certificate must contain particulars of work done, the place at which the work was carried out and must identify the aircraft to which it relates.

The form of a Certificate of Compliance is given in Figure 3.

CERTIFICATE OF COMPLIANCE

I hereby certify that the inspection/overhaul/repair/replacement/modification specified above has been carried out in accordance with the requirements of Chapter A4—3 of British Civil Airworthiness Requirements.

(Signed) .....

(Firm) .....

A.R.B. Approval Ref.

or Licence No. .....

Date .....

FIGURE 3.

A Certificate of Compliance may be issued only by the following:

1 Appropriately licensed aircraft maintenance engineers or radio maintenance engineers.

2 Authorised representatives of appropriately approved inspection organisations.

3 A person or firm authorised by the Minister to issue a certificate in a particular case.

The category of licence(s) required for the issue of a Certificate of Compliance will depend on the work involved as defined in A.R.B. Notice No. 3.

Aircraft, Engine and Propeller Log Books

Aircraft, engine and variable-pitch propeller log books must be kept in respect of every public transport aircraft and aerial work aircraft registered in the United Kingdom. The purpose of log books is to record the overhauls, modifications, replacements, repairs and the maintenance work done on an aircraft, engine or propeller together with any related certifications.

As the log book is intended to provide a complete history of the aircraft, engine or propeller, it is essential that all entries are made neatly and accurately and that sufficient detail is given to be of subsequent value to the maintenance of airworthiness.

When particulars of work done are so voluminous that it is inconvenient to enter them in the space provided in the log book, these particulars may be entered in a separate record, which should be numbered for identification and suitably certified in the same manner as that required for log book entries. This separate record is considered part of the log book and should be retained in a safe place so that it can be produced at any time required.

The reference number of the record, together with particulars of the place where it is held and a brief description of the work to which the record refers, should be entered in the log book.

Aircraft, engine and propeller log books must not be carried in the aircraft to which they relate.

Note: Licensed engineers are constantly under A.R.B. general supervision, since the work they certify is the subject of log book entries and log books are always perused by the Surveyor at the time of renewal of a Certificate of Airworthiness.

Operating Times Particulars of the date and duration of each flight or, if more than one flight is made on the same day, the number of flights and total duration of flights on that day must be entered in the aircraft log book.

Particulars of the date and duration of each occasion on which the engine is run on the ground or in flight or, if the engine is run on more than one occasion on the same day, the number of runs and total duration of the running on that day must be entered in the engine log book.

Particulars of the date and duration of each occasion on which the variable-pitch propeller is run in flight or, if the propeller is run on more than one occasion on the same day, the number of occasions and the total duration of the running on that day must be entered in the propeller log book.

The appropriate flight times should be determined from the record in the Technical Log, and should be entered in the appropriate log books, on a "chock to chock" basis, the periods between overhauls being determined by the sum of these times. Ground running times for engines should not be included in the running total of hours, since such times do not form part of the approved periods between engine overhauls.

When a Certificate of Airworthiness is to be renewed after overhaul of an aircraft, the accumulated flying times in the aircraft log book should be checked for accuracy by the engineer concerned with the overhaul, and the page ruled off under the last entry. The total time run should be carried forward to the appropriate column of the next page, but the time since overhaul should be recommenced from zero in the appropriate column of the next page. A similar procedure should be followed on each occasion when the check cycle specified in the

Maintenance Schedule for aircraft maintained on a progressive overhaul system is completed.

Maintenance Entries should be made in the appropriate log books to the effect that the check cycle specified in the Maintenance Schedule has been carried out and should be signed by the appropriate licensed engineer, together with the date the check was completed and the reference number of the Maintenance Schedule.

If any overhaul, repair, replacement, modification or inspection is made as a result of the check cycle, or due to any other reason, details should be entered in the appropriate log book and a Certificate of Compliance appended.

If the defect has been entered in the technical log, a copy of the Certificate of Compliance in respect of the work done to rectify the defect must be appended to the Technical Log in such a position or manner as to be readily identifiable with the entry to which it relates.

Technical Log A Technical Log is carried in all aircraft to which a Maintenance Schedule relates, and it is the responsibility of the commander of the aircraft to enter in the Technical Log the times at which the flight began and ended and details of any defect in any part of the aircraft which may be known to him; being a part to which a Maintenance Schedule relates; if no such defect is known to him he must make an entry to that effect. The duplicate copy of the record of defects, together with details of the rectifications made and the Certificate of Compliance, must be removed from the aircraft at the end of each flight.

Chapter IV

PROCEDURE FOR THE GRANT, EXTENSION AND RENEWAL OF LICENCES

Licences are granted, extended and renewed subject to applicants complying with the conditions and requirements set out in the following paragraphs.

Initial Grant of Licences

An applicant must not be less than 21 years of age.

An applicant must be able to read, write and converse in the English language.

A preliminary application form (Form A.R.B. 300C) together with a Schedule of Inspection Work (Form A.R.B. 301), must be completed in respect of each application and returned to the A.R.B. The Schedule of Inspection Work is a document giving details of the applicant's experience relevant to the type for which application is made. Information regarding the details required is given in Section L of B.C.A.R.

If the experience detailed in the preliminary application form is satisfactory to the A.R.B., the applicant will be requested to complete and return a final application on Form A.R.B. 302, together with the fee of £5 0s. 0d. (Except in the case of initial applications for an "A" and "C" licence for a helicopter, when a combined fee of £8 10s. 0d. is charged.)

An applicant must have had the experience, and must pass the examinations, appropriate to the category of licence required, as detailed in the appendix to Section L of B.C.A.R.

An exemption from some parts of the A.R.B. examination (e.g. Basic Aeronautical Engineering), is permitted to Associate Members of the Society of Licensed Aircraft Engineers and Technologists provided that, at the time of application, the appropriate S.L.A.E.T. Examination Certificate is produced. Information regarding the S.L.A.E.T. examinations is given in Chapter VII.

Details of the exemption scheme for various categories of licences are shown in Figure 4.

Aircraft Maintenance Engineer Licence Categories	Holders of A.M.S.L.A.E.T. Examination Cert. who have passed S.L.A.E.T. subjects 1 and 3 plus S.L.A.E.T. subjects	Are exempted from	But are required to complete
"A" and "B"	2A & 4A	A.R.B. Basic	A.R.B.—oral
"C" and "D"	2A & 4B	A.R.B. Basic	A.R.B.—oral
"A" and "C" (Helicopters)	2A & 4C	A.R.B. Basic	A.R.B.—oral
"X" (Instruments)	2B & 4D	A.R.B. Basic	A.R.B.—oral
"X" (Autopilots)	(no exemption applicable)		A.R.B.—written and oral
"X" (Electrical)	2B & 4E	A.R.B. Basic	A.R.B.—oral
"X" (Compasses)	(no exemption applicable)		A.R.B.—written and oral

FIGURE 4.

For the purpose of exemption, the A.R.B. will recognise only the official A.M.S.L.A.E.T. Examination Certificate, detailing the subjects in which the member has been examined, bearing the seal of the Society and signed by the Chairman of the S.L.A.E.T. Central Examining Authority.

The scheme of exemptions is liable to extension and amendment from time to time. Details of the scheme currently in operation are available from the Society.

Extension of Licences

A preliminary application form (Form A.R.B. 300C) together with a schedule of Inspection Work (Form A.R.B. 301), must be completed in respect of each extension required, to show details of the applicant's experience, and be returned to the A.R.B.

If the experience detailed in the preliminary application is satisfactory to the A.R.B., the applicant will be requested to complete and return a final application on Form A.R.B. 302 together with the fee of £3 10s. 0d. (Except in the case of applications for extension of "A" and "C" categories for a helicopter when a combined fee of £7 0s. 0d. is charged.)

An applicant must have had the experience, and must pass all or any of the examination subjects appropriate to the extension required.

Re-examination

Applicants who fail to pass the examination, in respect of the grant or extension of licence, will not be accepted for further examination for the same duties of certification as previously applied for, until additional knowledge has been gained of such duties. In these cases it may be necessary for the A.R.B. to advise the applicant what further practical experience it considers necessary.

Renewal of Licences

An application on Form A.R.B. 302 must be completed and returned to the A.R.B., together with a fee of £2 10s. 0d. Should re-examination be necessary, the holder of the licence will be notified by the A.R.B. and an additional sum will be chargeable, making £5 0s. 0d. in all.

Licences are normally valid for a period of twelve months and will be renewed on application provided that, during the twenty-four months preceding the date of expiry of the licence, the holder has been engaged for periods totalling at least six months on work which can be considered as comparable with the duties and privileges for which the licence is rated. Where these conditions have not been fulfilled the engineer may maintain the validity of his licence by complying with the requirements for the grant of a licence. The extent of the examination will depend on the nature of the employment of the holder since the licence expired, and the degree to which such duties could be considered as comparable to those for which his licence is endorsed.

During the period of validity of a licence, the holder must inform the A.R.B. of any change of address or place of employment.

Addresses

All A.R.B. Forms referred to in this chapter may be obtained from: The Secretary, Air Registration Board, Brabazon House, Redhill, Surrey.

Chapter V

THE FORM OF THE EXAMINATION

The examination for the issue of, or extension to include a new category of, an Aircraft Maintenance Engineer's Licence is in two parts—written and oral.

The first part is a written paper covering the Air Navigation Order and the A.R.B. Requirements and Recommendations appropriate to an aircraft maintenance engineer licensed in the category for which application is made. It is also a test of Basic Aeronautical Engineering knowledge appropriate to the construction of the type for which application has been accepted. The examination paper includes both Objective (or so called multi-choice) questions and Essay-type questions.

The Objective Questions

In the multi-choice questions, only one of the three alternative answers is right and, read in conjunction with the introduction, it is a straightforward statement of fact which is correct in all aspects but is not necessarily the full story on a given subject. The two wrong answers are incorrect in some definite aspect and are not wrong merely because the right answer is more desirable. In this form of examination the correct answer is supplied to the candidate and it is for him to decide and indicate which it is. The candidate virtually "marks" the paper from his technical knowledge and the A.R.B. then assesses his decisions.

As a guide to the method of proceeding with this form of examination, the following is extracted from "Instructions to Candidates":—

"The (examination question) folder contains Objective-type examination questions, each question having three answers marked A, B and C. Read each question carefully and the relevant alternative answers given and having decided which answer you consider is correct enter on the (separate) Answer Sheet against the corresponding question number either A, B or C as appropriate.

"If you do not know which is the correct answer you should leave the appropriate space blank. If this is because you are in doubt about the intention of a question or feel that it is ambiguous in any way or if this is because you consider that none of the answers given is correct, you may qualify your decision by a note on the back of the Answer Sheet.

"Every tenth question number is suffixed:— /0. It is hoped that this may serve as a reminder to check that questions and answers are not getting out of phase.

"If you have made any errors strike out the incorrect letter and enter alongside it the letter you wish to be accepted."

This form of examination is not a guessing game and the candidate who thinks he can beat the law of averages and achieve a "Pass" standard by guessing a "letter" when he does not know the correct one is deluding himself. He will achieve a far better standard by attempting only those questions for which he knows the right answers and leaving the remainder blank.

The Essay Questions

On the Essay paper, a space of one inch to three inches in depth on foolscap paper is provided under each question. The space allowed serves to indicate the extent of the detail required to answer the question, assuming the handwriting of the candidate is not above normal size. If the candidate cannot contain his answers in the spaces provided he may use the blank side of the last sheet of the Examination paper to conclude them.

The questions, in the main, relate to methods of inspection, e.g. "Detail how an exhaust valve should be checked for condition quoting defects and typical limits".

Before starting to write, each question should be read carefully in order to avoid wasting time and space in giving details irrelevant to the question.

A useful exercise for the candidate will be to consider the question as if it were one put to him by an apprentice. If this were the case the candidate would first state briefly, in short sentences, the points that should be checked. The apprentice would then want to know how the checks mentioned are carried out and, in the example given above, the limits leading to the rejection or acceptance of the valve. The candidate would no doubt demonstrate the checks, using equipment as necessary, and if the valve were found to be unserviceable in one or more respects he would point them out to the apprentice.

In the written examination the candidate should therefore jot down the possible defects, stating how they are checked (either visually or by measurement), and giving the acceptable limit in each case.

Some of the better answers are those which give the details asked for with an economy of words: i.e. quality is preferable to quantity. Marks are not lost for lack of neatness in handwriting, mistakes in spelling or ungrammatical statements—it is facts and statements obviously indicating "know how" that score marks.

Specimen multi-choice and essay questions are included at the end of this Chapter. Candidates not accustomed to writing answers in spaces allocated by the examiners will no doubt find it beneficial before the day of the examination to practise by selecting a few specimen essay questions and, on foolscap width paper, seeing how much of the information required in the question they can get into a space of say, two and a half inches, without undue padding of words and repetition of statements. As a guide to the time available, half-an-hour is allowed for completing one side of foolscap and there are normally three sides to complete in the Essay paper.

The Oral Examination

Candidates who reach a satisfactory standard in the written "Basic" examination then attend for oral examination on the type. The acceptance of the application for the licence has, apart from age, and general and specific experience, been determined by the comprehensiveness of the Schedule of Inspection Work submitted. In the oral examination, during which the candidate may be required to answer supplementary Basic questions which are considered necessary to clarify statements or make good omissions in the written paper, the candidate must be prepared to answer questions relating to items of inspection with which he claims, at least by participation, experience in his Schedule. Candidates are advised, therefore, to ensure that they are conversant with matters relating to the details of work submitted and not to enter items on the Schedule merely on the basis of a passing reference, as it may well be that in the oral examination, should these particular items be dealt with, the candidate will have difficulty in giving satisfactory answers. This could be detrimental to the overall assessment of his oral examination.

Specimen Questions

1. REGULATIONS

The period of validity of a Certificate of Maintenance:—

(A) expires after a specified number of flying hours or period of time, whichever may be the earlier.
(B) expires only after a specified number of flying hours.
(C) expires only after a specified number of days.

For a public transport aircraft, entries of defects in the technical log must be transferred to (or referred to in) the appropriate log book:—

(A) as soon as the defect is rectified.
(B) within a maximum time of six months of the defect occurring.

(C) not more than seven days after the expiration of the certificate of maintenance in force at the time of the occurrence.

An Approved Certificate which lists more than one item:—

(A) is invalid in all cases.
(B) is acceptable only where similar items are concerned.
(C) is acceptable provided each item can be readily correlated with the certificate.

A bonded store is provided in an approved inspection organisation for materials and parts:—

(A) until such time as they are proved to conform to specification.
(B) which have been proved to conform to specification and are appropriately released.
(C) which are awaiting the arrival of Approved Certificates.

A duplicate inspection of a control system:—

(A) is first made and certified by one person, and then repeated by another person, and again certified.
(B) is carried out by the person who is to certify both parts of the inspection in conjunction with the person who carried out the work.
(C) is first made by one person and then repeated by another person, and on completion the person who carried out the work certifies the inspection.

2. CATEGORY "A"—OBJECTIVE QUESTIONS

The centre of pressure is:—

(A) the point on the chord line through which the total resultant lift force on the aerofoil may be said to act.
(B) the point of maximum pressure on the under surface of a mainplane.
(C) the point at which the four forces acting on an aircraft are said to act.

The lateral axis of an aircraft is the straight line:—

(A) passing through each wing tip.
(B) passing through the centre of gravity and parallel to a line joining each wing tip.
(C) passing through the centre of pressure at right angles to the airflow.

Dihedral is incorporated in an aircraft to provide:—

(A) lateral stability about the longitudinal axis.
(B) longitudinal stability about the lateral axis.
(C) lateral stability about the normal axis.

Stability of an aircraft:—

(A) is its tendency to return to the original trimmed position after having been displaced.
(B) is the ability of an aircraft to rotate about an axis.
(C) is the tendency of an aircraft to stall at low airspeeds.

The purpose of the primary stops in a flying control system:—

(A) is to prevent damage to the system when the aircraft is parked in high winds.
(B) to act as a stop in case of flutter of the controls.
(C) is to restrict the movement of the control to the correct range.

The centre-line of a fuselage may be accurately transferred to a ground line:—

(A) by dropping plumb-bobs from the nose and the rudder, and joining the two marks.
(B) by dropping plumb-bobs each side of the fuselage at points along its length, and joining their mid-points.
(C) by measuring the distance between the main wheels and joining the mid-point to the nose wheel or tail wheel centre.

A red light showing on the undercarriage indicator during retraction test indicates that the leg concerned:—

(A) is up and locked.
(B) is between the up and the down locks.
(C) is down and locked.

To obtain the correct conditions for checking the flow of fluid through a flexible pipeline:—

(A) the pipe should be supported horizontally 12 inches below the surface of fluid in the supply tank.
(B) the pipe should be supported vertically with the free end vertically below a supply tank containing 12 inches of fluid.
(C) the pipe should be supported in the position it occupies when installed, with the free end 12 inches vertically below the bottom of the supply tank.

The lubricant to be used to assist in fitting an aircraft tyre:—

(A) is castor base oil.
(B) is non-caustic soapy water.
(C) is paraffin.

The series of concentric moulded lines on the side wall of an aircraft tyre are used:—

(A) to indicate the concentricity of the tyre to the wheel.
(B) to indicate the amount of relative movement of the tyre around the wheel.
(C) to indicate under or over inflation.

In marking out rivet positions on a repair, the normal minimum distance between the rivet hole centre and the edge of the plate is:—

(A) 1·5 × rivet diameter.
(B) 3 × rivet diameter.
(C) 2 × rivet diameter.

The screws used in aircraft wooden structures are usually:—

(A) of ferrous material.
(B) of non-ferrous material.
(C) of light alloy material.

In a simple electrical circuit, if the power consuming devices are in parallel, the total current consumed is equal to:—

(A) the sum of the currents taken by the devices divided by the number of devices.
(B) the sum of the currents taken by the devices.
(C) the sum of the reciprocals of the currents taken by the devices.

When carrying out a bonding test, the double-pronged lead of a bond test-meter:—

(A) is attached to the aircraft main earth.
(B) is used as a probe.
(C) is attached to the component under test whilst the single-pronged lead is used as a probe.

The difference of electrical potential in a circuit is measured in:—

(A) amperes.
(B) volts.
(C) watts.

Cabin differential pressure is the pressure difference between:—

(A) the pressure inside the cabin and sea level barometric pressure.
(B) the ambient pressure and the pressure at 8,000 ft.
(C) the pressure inside the aircraft and the ambient air pressure.

Application of the initial coat of dope on a fabric surface by brush is recommended:—

(A) as spraying would cause the dope to penetrate the fabric.
(B) to enable the fibres of the fabric to be laid with the brush.
(C) to ensure complete impregnation and so obtain the greatest tautening effect.

The presence of "orange-peel" effect on a newly applied coat of dope may have been caused by:—

(A) air line pressure too low.
(B) drying of the dope by application of heat.
(C) the addition of anti-chill thinners to the dope.

Relative humidity in a dope shop is measured:—

(A) by a hydrometer in conjunction with a chart.
(B) by a hygrometer in conjunction with a chart.
(C) by a barometer in conjunction with a chart.

The depth of a dent in a tubular structural member may be accurately measured:—

(A) by a piece of cord stretched across the dent and the distance to the bottom of the dent measured by rule.
(B) by a steel ball of any diameter placed in the dent and the overall "diameter" measured.
(C) by setting a pair of calipers to the diameter of the tube, slipping one leg into the dent and using feelers under the second leg.

Grade "A" solder is identified by the colour code of:—

(A) brown.
(B) red.
(C) blue.

A locknut may be distinguished from a plain nut:—

(A) by its castellations.
(B) because it is thinner.
(C) because it is wider across the flats.

The standard code used to indicate the size of aircraft bolts:—

(A) applies only to B.S.F. bolts.
(B) applies to B.A. and Metric bolts.
(C) applies to B.S.F. and B.A. bolts.

A cold rolled high tensile steel bolt is identified:—

(A) by the letter X on the head.
(B) by nicks machined on the corners of the hexagon.
(C) by a raised ring on the head.

A new rivet can be identified as being made of aluminium:—

(A) if it has natural colouring and a dimple on the head.
(B) if it is coloured black and has the letter "S" on the head.
(C) if it is coloured black and has the letter "A" on the head. shank end

An altimeter is operated:—

(A) by bourdon tube.
(B) by aneroid capsule.
(C) by pressure diaphragm.

Split pins:—

(A) must not be used more than once.
(B) may be used repeatedly provided the bends are free from cracks.
(C) may be used twice provided only one leg is bent in each application.

Torque loading is determined by multiplying the tangential force applied at the free end of the spanner:—

(A) by the diameter of the bolt and the distance of its point of application.
(B) by the distance of its application from the axis of the bolt.
(C) by the distance moved by the point of application.

3. CATEGORY "A"—ESSAY QUESTIONS

Describe the procedure for carrying out a symmetry check.

Describe how the condition of a control cable may be assessed when it has been removed after considerable service.

Describe the checks required after replacing a section of a flying control run.

Describe a typical check which requires the use of an inclinometer.

Describe how to assess the condition of a tubular structural member which appears to be bowed.

Describe how to remove corrosion from a steel part, in situ.

Describe the action required if electrolyte has been spilled in an aircraft.

Describe how to inspect a metal aircraft after a pilot reports a suspected lightning strike.

Describe a leak test on an A.S.I. system.

Describe how to measure the insulation resistance of a circuit incorporating a fuse, switch and a lamp.

A hydraulic jack is suspected of having a leak past the piston. Describe how to determine whether or not the jack is serviceable.

Describe a dye-penetrant check on a landing wheel.

Describe how acceptable balance is achieved when assembling a tyre (including tube, if any) to an aircraft wheel.

Describe how to determine the serviceability of a hand fire extinguisher.

Describe how to assess the condition of an installed safety harness or safety belt after a period of service.

4. CATEGORY "C"—OBJECTIVE QUESTIONS

A breather is fitted to an engine:—

(A) to allow for changes in atmospheric temperature.
(B) to allow for changes in oil pressure.
(C) to relieve pressures in the crankcase.

Multiple springs are used on poppet valves employed in aircraft engines:—

(A) to reduce the amount of valve lift.
(B) as a safety measure and to reduce valve bounce.
(C) to increase the thermal efficiency of the engine.

The swept volume of an engine cylinder:—

(A) is the cross-sectional area of the cylinder bore multiplied by the piston stroke.
(B) is the total cylinder volume divided by the crankshaft throw.
(C) is the compression ratio multiplied by the clearance volume.

The purpose of sodium filling in an exhaust valve is:—

(A) to reduce valve guide wear.
(B) to prevent carbon adhering to the valve stem.
(C) to conduct heat away from the valve head.

If compressor blade stall occurs:—

(A) the smooth flow of air over the blading breaks away and may cause an interruption of flow through the engine.
(B) the compressor assembly ceases to rotate in the normal direction.
(C) the fuel flow to the burners will cease immediately.

Under normal running conditions, the flow of gases through combustion chamber interconnectors:—

(A) is continuous in order to keep the flame stable.
(B) is dependent on compressor delivery pressure.
(C) is negligible as each chamber should be operating at the same pressure.

In a gas turbine engine, a typical air/fuel ratio in the combustion zone of a combustion chamber is:—

(A) 10:1.
(B) 50:1.
(C) 18:1.

In a type of contact breaker where the gap affects the timing, a gap which has become too large:—

(A) will cause the engine to detonate.
(B) will advance the ignition timing.
(C) will retard the ignition timing.

On starting an engine from cold, the actual oil pressure within the engine will rise:—

(A) to the normal operating pressure and remain stable until the engine warms up.
(B) to a figure lower than the normal operating pressure and will rise as the engine warms up.
(C) to a figure greater than the normal operating pressure and will fall as the engine warms up.

An ignition switch which became shorted out for one magneto would result in:—

(A) inability to start the engine.
(B) inability to stop the engine.
(C) a dead cut when the switch for the other magneto is switched off.

The use of carburettor hot air reduces engine power:—

(A) because the weight of mixture to the cylinders is decreased.
(B) because the weight of mixture to the cylinders is increased.
(C) because the weight of mixture to the cylinders is unaltered, and the air temperature is increased.

Circlips used to secure locking plates in a propeller:—

(A) must be used once only.
(B) may be used repeatedly providing they spring positively into position.
(C) may be shortened and re-formed to achieve positive-locking.

High frequency vibration due to a slight turbine defect may cause:—

(A) high jet pipe temperature throughout the range.
(B) fluctuation of engine torquemeter pressure throughout the range.
(C) cracking of engine components.

A flexible fuel pipe undergoing inspection after a period of service requires to be checked electrically:—

(A) for continuity of the integral bonding and insulation of the outer cover.
(B) for insulation of the outer cover only.
(C) for continuity of the integral bonding only.

Slight cracking due to ageing of the cover of a flexible fuel pipe:—

(A) reduces the fuel flow to the engine.
(B) always indicates that the pipe has exceeded its "life".
(C) does not in itself render the pipe unserviceable.

When an aircraft fuel system is flow tested, the fuel tanks:—

(A) must be full.
(B) must not contain less than a specified quantity of fuel (usually 50% of the usable fuel capacity).
(C) must not contain more than a specified quantity of fuel (usually 10% of the usable fuel capacity).

Oil is pumped through a gear type oil pump:—

(A) by being carried between the teeth of each gear round the "outside" of the meshing gears.
(B) by being forced through the meshing teeth of the gears.
(C) by centrifugal force.

With all prongs of a bond test-meter placed together:—

(A) full scale deflection should be registered.
(B) a zero reading should be registered.
(C) a minimum of 10 megohms should be registered.

A method normally used to achieve a fuel-tight joint between a flexible pipeline and a component is:—

(A) the application of self-sealing compound externally.

(B) a fitting on the pipe end seating on a mating surface on the component.
(C) a chevron-type seal expanded by fuel pressure.

The direction of flow through a non-return valve is indicated:—
(A) by an arrow on the exterior of the valve.
(B) by the difference in size of the inlet and outlet connections in all cases.
(C) by the position of the valve only.

When checking a Megger prior to use, if the test leads are held apart and the handle turned:—
(A) an infinity reading should be observed on the scale.
(B) a minimum of 20 megohms should be observed on the scale.
(C) a zero reading should be observed on the scale.

Anodic treatment of an aluminium alloy:—
(A) plates the surface of the alloy with pure aluminium.
(B) produces an aluminium oxide film on the surface of the material.
(C) enables the material to be worked more easily.

A tolerance is:—
(A) a required difference in dimension between mating parts to obtain a certain class of fit.
(B) a permitted variation on a dimension to allow for inaccuracy of equipment or workmanship.
(C) a permitted difference between new and worn dimensions.

Poppet valve stems may be checked for wear:—
(A) by micrometer, at three or more positions along their length.
(B) by ring gauges, go and no go, at their extremities.
(C) by a profile gauge being placed against the stem and feelers inserted where possible.

After completion of electro-magnetic crack detection, the test piece must be:—
(A) allowed to cool to room temperature as slowly as possible.
(B) allowed to lose any residual magnetism over as long a period as possible.
(C) de-magnetised before being returned to service.

Units used for expressing torque loading values are:—
(A) pounds (lb.).
(B) lb.ft. and lb.in.
(C) lb./sq.ft. and lb./sq.in.

The British Association (B.A.) thread is the standard thread in aircraft use:—
(A) for threads in light alloy.
(B) for bolts under $\frac{1}{4}$ inch diameter.
(C) for pipes over $\frac{1}{4}$ inch internal diameter.

Fretting corrosion may be caused by:—
(A) two dissimilar metals in contact.
(B) incorrect heat treatment.
(C) slight movement between bolted parts.

If it is necessary to remove corrosion from a welded steel engine mounting in situ, the base of a suitable solution for this purpose is:—
(A) chromic acid.
(B) nitric acid.
(C) phosphoric acid.

Water/Glycol fire extinguishers should not normally be used:—
(A) on burning liquid or electrical fires.
(B) in confined spaces.
(C) in pressurised aircraft.

5. CATEGORY "C"—ESSAY QUESTIONS

Describe how to use a piston position indicator for finding top dead centre of a piston in a cylinder.

Describe how to check the fit of a piston ring in its groove.

Describe how an engine sparking plug should be tested after it has been cleaned and inspected.

Describe the tests required on an ignition system after an ignition switch has been fitted.

Describe the tests required to assess the condition of a screened H.T. ignition cable after a period of service.

Describe how to carry out a typical test using a dead weight tester.

Detail typical limits applicable to defects on propeller blades. State material.

Describe a method of crack detection which is suitable for aluminium alloy.

Describe how particles found in an oil filter may be positively identified as white metal.

Describe the checks required to assess the condition of a valve spring, stating equipment used and typical limits.

Describe the inspection and test necessary after the installation of a flexible fuel pipe.

Describe the checks to be made when fitting a bonding conductor between parts where relative movement is involved.

Describe how to check the fit of a 1 inch dia. shaft in a bush.

Detail the points to be checked when inspecting the locking of a screwed part by a tab washer.

During a fuel flow test 2 pints are collected in 36 seconds. Show whether or not this satisfies the requirements for a pump fed engine with a maximum consumption of 14·5 g.p.h.

6. CATEGORY "X"—ELECTRICAL—OBJECTIVE QUESTIONS

The unit of quantity of electricity is:—

(A) the farad.
(B) the watt.
(C) the coulomb.

Twenty-five millivolts is equal to:—

(A) 0·025 volt.
(B) 0·250 volt.
(C) 0·0025 volt.

Ten microfarad capacitors will give an overall capacitance of:—

(A) one microfarad when connected in series.
(B) one microfarad when connected in parallel.
(C) 100 microfarads when connected in series.

The inductance of a circuit is said to be:—

(A) one henry when the voltage changes at the rate of one volt per second.
(B) one farad is a current of one ampere is induced when the voltage changes at the rate of one volt per second.
(C) one henry if an e.m.f. of one volt is induced when the current changes at the rate of one ampere per second.

The apparent power in an a.c. circuit may be determined by applying the formula:—

(A) $I^2 \times R$.
(B) $Z \times E$.
(C) $E \times I$.

The current in a purely capacitive circuit:—

(A) will lead the applied voltage.
(B) will lag the applied voltage.
(C) will be in phase with the applied voltage.

The frequency of an alternator may be determined:—

(A) by dividing the number of phases by the voltage.
(B) by multiplying the number of poles by 60 and dividing by the r.p.m.
(C) by multiplying the r.p.m. by the number of pairs of poles and dividing by 60.

A circuit breaker is a device for:—

(A) protecting an electrical circuit from current overload.
(B) collapsing the primary circuit in a magneto.
(C) completing a circuit without being affected by current flow.

As the size of cable increases:—

(A) the volts drop per unit length with rated current flowing increases.
(B) the volts drop per unit length with rated current flowing decreases.
(C) the current carrying capacity decreases.

When a carbon pile voltage regulator is installed in an aircraft, voltage adjustments should be made:—

(A) by the voltage trimmer resistance.
(B) by the pile compression screw.
(C) by the magnetic core screw.

In a three-phase alternator, the sum of the three voltages at any instant in time is:—

(A) equal to the maximum value of one phase multiplied by 3.
(B) zero.
(C) equal to the R.M.S. value of one phase multiplied by 3.

The electrolyte in a lead-acid battery contains:—

(A) sulphuric acid.
(B) hydrochloric acid.
(C) nitric acid.

Cable end fittings made of copper:—

(A) may be used with aluminium cable.
(B) must not be used with aluminium cable.
(C) are only available in the 4-10 amp. range.

The results of an insulation resistance test of an electrical cable:—

(A) also indicate the continuity of the cable.
(B) will vary with the weather conditions under which the aircraft is tested.
(C) will always be infinity if the cable is correctly installed.

A short-circuit in a "single pole" electrical circuit would be caused:—

(A) by a broken conductor between the source of supply and an item of equipment.
(B) when wiring between the source of supply and an item of equipment is down to earth.
(C) by an open circuit between an item of equipment and earth.

A spring washer:—

(A) may be used repeatedly so long as it continues to provide an efficient lock.
(B) must not be used more than once.
(C) may be used a second time provided it is fitted the reverse way round.

For battery charging, the electrical supply connected to the battery must be:—

(A) d.c.
(B) a.c. at 400 c.p.s.
(C) a.c. at 50 c.p.s.

During battery charging, if the temperature of the electrolyte becomes excessive it may be reduced:—

(A) by increasing the charging rate.
(B) by drawing off surplus electrolyte.
(C) by decreasing the charging rate.

In an a.c. motor, the difference between synchronous speed and the speed of the rotor is termed:—

(A) the motor loss speed.
(B) the brake speed.
(C) the slip speed.

7. CATEGORY "X" — ELECTRICAL — ESSAY QUESTIONS

Calculate the total resistance and volts drop over each part of a circuit which consists of a 16 ohm resistance in series with two parallel resistances of $13\frac{1}{3}$ ohms and 20 ohms. The p.d. is 30 volts.

Describe the operation of a current transformer.

Describe typical routine maintenance checks on actuators in situ.

Describe the tests which are periodically required on a lead-acid battery.

Describe how to ascertain that replacement cable has been correctly installed as regards cable run and attachment to the aircraft structure.

Describe the operation of a metal plate rectifier.

Describe the inspections and tests necessary after making earth connections for high current consumption equipment.

Describe the action that takes place within a carbon pile voltage regulator when a higher than bus-bar setting voltage is being corrected.

With the aid of a schematic diagram, describe how an alternator can be excited and its output voltage controlled.

List the defects that are likely to be found when inspecting the commutator and brush gear of a motor.

8. CATEGORY "X" — INSTRUMENTS — OBJECTIVE QUESTIONS

In the International Standard Atmosphere, pressure decreases:—

(A) at a constant rate as altitude decreases.

(B) at a rate of approximately 1 millibar per 30 ft. between sea level and 3,000 ft. altitude.

(C) at a rate of approximately $\frac{1}{2}$ lb./sq.in. per 1,000 ft. above 10,000 ft. altitude.

Fahrenheit may be converted to Centigrade by using the equation:—

(A) $C = (\frac{9}{5} \times F) + 32.$

(B) $C = (\frac{9}{5} \times F) - 32.$

(C) $C = \frac{5}{9} (F - 32).$

A decrease in the temperature of air at constant pressure will:—

(A) increase its density.

(B) decrease its density.

(C) have no effect on its density.

When checking a sensitive altimeter on a pre-flight inspection:—

(A) the ambient air pressure is set on the millibar scale.

(B) the ambient air pressure corrected for temperature is set on the millibar scale.

(C) the standard sea level barometric pressure is always set on the millibar scale.

In a gyroscope, as the speed of the rotor increases, the rate of precession for a given torque:—

(A) remains constant.

(B) decreases.

(C) increases.

In an artificial horizon, the model aeroplane is fixed:—

(A) to the inner gimbal ring of the instrument.

(B) to the rotor of the instrument.

(C) to the outer case of the instrument.

The direct reading type of oil pressure gauge is operated:—

(A) by bourdon tube.

(B) by aneroid capsule.

(C) by pitot tube.

The fluid suitable for use in a dead weight tester is:—

(A) kerosene.
(B) castor oil.
(C) anti-freeze oil.

A non-return valve is installed in a system:—

(A) with the arrow in the direction which requires free flow.
(B) with the arrow in the direction which requires no flow.
(C) with the arrow uppermost in all cases.

The magnetic polarity of a solenoid can be determined by:—

(A) the right hand grasp rule.
(B) Fleming's right hand rule.
(C) Lenz's law.

If the ampere turns of a solenoid are increased, the magnetic field strength will:—

(A) decrease.
(B) remain the same.
(C) increase.

The leads of thermocouple operated instruments:—

(A) are calibrated for a particular installation and should not be shortened.
(B) must be lagged to prevent heat loss between the thermocouple and the instrument.
(C) carry high currents and voltages.

Check calibration of the zero reading of a fuel contents gauge is carried out:—

(A) with the unusable fuel remaining in the tank.
(B) with the tanks completely empty.
(C) with 10% of fuel tank capacity in the tanks.

During pressurised flight, a slight leak in the pipeline to an altimeter will cause the instrument to read:—

(A) an altitude which is higher than the actual aircraft altitude.
(B) an altitude which is lower than the actual aircraft altitude.
(C) the cabin altitude.

A desiccant used in the storage of instruments:—

(A) is silica-gel.
(B) is anti-freeze oil.
(C) is sodium-bicarbonate.

9. CATEGORY "X"—INSTRUMENTS—ESSAY QUESTIONS

Explain the procedure for obtaining a correct reading from a Kew type barometer.

With the aid of a schematic diagram, describe the operation of a Desynn indicating system.

In a flight director system describe how a pitch and roll signal is developed and how the information is presented.

Describe the millibar synchronisation check during a calibration check on an altimeter.

With the aid of a schematic diagram, describe the operation of an electronic type fuel quantity indicating gauge.

Describe the inspections and tests necessary after replacing an attitude indicator in a flight director system.

Describe typical routine maintenance checks and tests on pitot/static systems.

Describe typical routine maintenance checks on an electrically operated artificial horizon in situ.

Chapter VI

PREPARING FOR THE EXAMINATION

From Chapter V an idea of the form of the examination will have been gathered. It is obvious that, unlike an oral examination, no assistance with regard to the answers can be expected during the course of the examination itself.

To deal effectively with this written examination, which is set to cover a large syllabus with perhaps only one question to each sub-section, it is most important to cover the whole syllabus beforehand.

The following method is simple to apply and, if carried out honestly, provides a guide to those parts of the syllabus requiring special attention to bring the knowledge of them up to standard.

Expand and itemise the examination syllabus as given in Section L of British Civil Airworthiness Requirements, with the object of carrying out a self-conducted quiz to discover weak points which must be cleared up. Tick off all items of which knowledge is satisfactory and make notes against unsatisfactory items to indicate the facts, figures or even practical experience, which are required to complete your knowledge of the subject.

To illustrate the procedure, first the "A" licence syllabus, and then the "C" syllabus, will be considered in this way. The scheme should be sufficiently clear from these examples to enable candidates in Categories "B", "D" and "X" to apply it to the syllabus with which they are concerned

Studying the Syllabus for Aircraft Maintenance Engineer's Licence Category "A" Examination

In the written examination applicants will be required to answer questions to show their knowledge of the following subjects, according to the construction of the type or types for which they have been accepted.

The Air Navigation Order and Regulations and the A.R.B. Requirements and Recommendations Appropriate to an Aircraft Maintenance Engineer Licensed in Category "A".

An aircraft maintenance engineer should have access to the Rules and Regulations applicable to his duties even if he does not possess a personal copy. For the purpose of the examination, A.R.B. Handbook No. 1 (obtainable from the Air Registration Board, price 5/-) will be found convenient for study. It is not statutory, however, and should not be quoted as an authority. For this purpose, marginal references are given for all quotations from the Air Navigation Order and Regulations, and also British Civil Airworthiness Requirements, Civil Aircraft Inspection Procedures, and A.R.B. Notices.

The Requirements mainly applicable to the aircraft maintenance engineer are those prescribed in Sections "A" and "L" of British Civil Airworthiness Requirements. These are obtainable from the Air Registration Board, at prices of 5s. and 4s. respectively. (See Appendix.)

The Recommendations referred to in the syllabus are contained in Civil Aircraft Inspection Procedures which deal with the various aspects of inspection during overhaul, repair and maintenance of civil aircraft. The Inspection Procedures also contain information on workshop methods, processes and servicing, and information considered essential to the proper understanding of the procedures. These leaflets are issued periodically and are obtainable from the Air Registration Board. A set of Inspection Procedures as published to date may be obtained at a cost of £3 0s. 0d. including postage and packing, and regular receipt of new issues and amendments may be obtained by payment of an annual subscription of 17s. 6d., due on 1st July of each

year. A suitable folder for filing the Inspection Procedures may be obtained at a cost of 17s. 6d. including postage and packing.

Practical Arithmetical Calculations, Involving Vulgar and Decimal Fractions, Percentages and Mensuration

(i) Practical Arithmetical Calculations

The "A" licensed engineer has to make checks on incidence, stagger and dihedral. He should also be able to calculate the volume of a tank, the extent of bow in a member, or make a specific gravity check; he should understand how these measurements are expressed and resolved.

Elementary arithmetic, algebra, geometry and trigonometry. Solving simple calculations. Use of graphs and four figure tables. Free-hand sketching of components from which a finished drawing could be produced. A general knowledge of British standards, D.T.D., S.B.A.C. specifications, and any other specifications issued in connection with aircraft.

(ii) Vulgar and Decimal Fractions

In order to make the calculations required of an "A" licensed engineer, an acquaintance with fractions is necessary. A few problems involving the use of both vulgar and of decimal fractions should be solved. A good text-book on elementary arithmetic will be helpful when considering the rules for addition, subtraction, multiplication and division. Frequent practice is the only method of attaining any degree of proficiency even with this seemingly simple aspect of the syllabus.

(iii) Percentages

Again the arithmetical text-book will help and examples should be attempted until simple percentages such as $12\frac{1}{2}\%$, $8\frac{1}{3}\%$, or $16\frac{2}{3}\%$ can be calculated readily.

(iv) Mensuration

A thorough knowledge is necessary of British linear, square and cubic measures, angular and temperature measurement. The relation between British and Metric measures must be known and the rules for conversion of British into Metric units and vice versa.

The Various Terms Used in Aeroplane Construction and Aerodynamics and the Functioning of Each Component Part of the Aeroplane

(i) The Various Terms Used in Aeroplane Construction and Aerodynamics

A knowledge is required of such terms as incidence, dihedral, symmetry, sweepback, angle of attack, chord, span, yaw.

(ii) The Functioning of Each Component Part of an Aeroplane

This means the exact purpose of each individual component part and its function. Practice should be obtained in writing short, concise descriptions of the action of frise and differential ailerons, trim and servo tabs. Obtain a thorough understanding of the function of such parts and of the need for correct setting.

The Preparation of a Brief Report, Illustrated by Sketches if Necessary, Describing the Replacements Required in the Event of Damage, Defect or Wear

Practice is most useful in the compilation of reports dealing with typical defects and sustained damage after a forced landing, together with the rectification work and replacements necessary to render the aircraft fit to "fly-off". Practice should be obtained in drawing lines sketches of typical repairs, such as holes in skin surrounding ribs, formers, etc., layout of hydraulic, vacuum and pneumatic systems.

The Inspection and Checks for Alignment After Assembly of Aeroplane Structural Components

The important thing to remember when describing details of inspections and checks is to set them down in the order in which they are carried out. Setting them down without regard to order, may lead the examiner to suspect that the applicant would make the inspection in a confused manner. The equipment to be used should also be detailed, e.g.: Is a piece of string suitable for a symmetry check from wing tip to tailplane?

The Inspection During and After Adjustment of Flying Controls

The remarks made about item 5 also apply here. Be sure that control surface movements are known, together with methods of locking turnbuckles, checks for safety, and so on. After adjustments or repairs to flying-control systems, a duplicate inspection is essential; this is a point which is frequently omitted. Since there may be difficulty in determining how much of a power-assisted or power-operated flying control system should be inspected in duplicate, the A.R.B. have given guidance on this point in leaflet AL/3-4 of Civil Aircraft Inspection Procedures.

The Correction of Faults Experienced in Flight with Particular Reference to Rigging and Control Setting

This is an item of the syllabus which is wide in scope and a list should be made showing typical faults; for example, left or right wing low; tail or nose heavy; yawing in flight; swinging on take-off or landing; controls tight or slack, heavy or light. After the typical faults have been considered, the possible causes should be set against each; these may be any one or more of the following:—

(a) maladjustment of control surfaces
(b) maladjustment of aircraft structure
(c) defect in a control surface
(d) defect in the aircraft structure
(e) incorrect or uneven distribution of load
(f) engine or propeller faults, according to type.

If the defects and possible causes are set out in tabular form, a third column should be added showing the rectifications, inspections and certifications necessary not forgetting duplicate inspection after any adjustment to the flying controls.

General Maintenance (Including Equipment) Minor Repairs

(i) General Maintenance and Minor Repairs

This can be expanded for consideration on the following lines: knowledge is required of the periodical maintenance and inspection checks carried out on the aircraft generally; the extent of the various inspections which are called for by the maintenance schedules and the certification of these; the cleaning and greasing necessary at regular intervals; the method of carrying out final inspections before flight. The relevant manufacturers' handbooks will give details of the minor repairs permitted. Consider, for example, a repair to the trailing edge of a rudder.

(ii) Equipment

What comes under this heading? It is convenient to consider here the items not specifically mentioned elsewhere in the syllabus, for example, lifebelts, safety belts, lap straps, etc.

Check whether you can answer these questions about each item:—

What periodical maintenance and inspection is performed? At what intervals? What testing apparatus is used? What are the requirements regarding them?

Defects and Deterioration of Metallic Materials, Treatments and Methods Used Against Corrosion

A list may be made of the defects and deterioration which may occur in ferrous and non-ferrous metal aircraft structures, for example: (1) corrosion, (2) bent fittings, bowed struts or members, (3) cracks due to fatigue, assembly stresses or stress-corrosion, (4) worn or elongated holes, bushes, etc., (5) worn bolts or pins. The list may then be expanded to show the limits of defect or deterioration which would permit the affected part to be put back into service, methods of measuring the extent of wear or deterioration and the methods of rectification which come within the scope of an "A" licensed engineer's duties as described in Chapter III. Practical knowledge should be obtained of the method of measuring a small hole for ovality.

When considering this item, as many examples as possible should be given, affecting both minor and major components. In addition, it should be remembered that the defects may be the result of abnormal conditions,

such as a heavy landing, which will call for an extensive inspection for the effect of transmitted stress.

The different processes for preventing corrosion should be studied, together with their application and suitability. Leaflets BL/4-1, BL/4-2, and BL/4-3 of Civil Aircraft Inspection Procedures give useful guidance on corrosion problems.

Defects and Deterioration of Wooden Structures, Including Treatments and Methods used in Connection with them, where Applicable

This may be approached in the same manner as the previous item and a list made of the various defects and types of deterioration which may be found. Some examples are:— (1) glued joint deterioration, including oil and water soakage, (2) separated laminations in members, (3) shrinkage, (4) compression shakes. The engineer must be able to recognise these and other forms of wood structure deterioration. Leaflet AL/7-9 of Civil Aircraft Inspection Procedures gives guidance on this important subject.

When the list of typical defects has been completed, the appropriate treatments and methods may be set down against each one, bearing in mind the scope of the "A" licensed engineer's duties as described in Chapter III.

Defects and Deterioration of Materials—Other than Wood or Metal Including Fabrics, Dopes, etc. Treatments and Methods used in Rectifying Defects Encountered, where Applicable

This item of the syllabus covers fabric, doping, stringing, transparent window material, glues and cements, etc. As in the previous item, a list should be compiled giving the typical defects which may develop in these materials, together with the necessary rectifications. In the case of fabric, practice should be obtained in writing descriptions of the repair of jagged holes, broken stringing, re-doping. It should not be forgotten that wrinkles in fabric or buckling of ply or metal skin usually indicate serious damage. The rectification work, or indeed the inspection, is not just a matter of replacing the covering.

The Inspection of Control Mechanisms for Defects and Deterioration

Again the best way to deal with this subject is to list the various defects which may be found—frayed cables, cables fouling, oil-soaked fair-leads, cables too tight or too slack, pulled splices, and so on—and against them detail the rectification necessary. The effect of climatic conditions on the tension of control systems should also be considered. Attention is again directed to the necessity for duplicate inspection after adjustments or repairs to the control system.

Inspection and Scope of Investigation following Heavy Landings

This is a wide subject, since the inspection following a heavy landing cannot be too thorough. As much detail as possible should be compiled, having regard to a definite order of investigation, from important to less important components. It should be noted that this investigation should include such parts as spars, engine bearers, tank attachments, instruments, seats and accumulators, as well as obvious structures like the undercarriage. The inspection should be continued until some defect provides evidence that the shock sustained has been relieved. It is surprising at times how far from the undercarriage the results of a heavy landing can be found, and experience has shown that it is exceptional if there is no damage. Guidance on this subject is given in Civil Aircraft Inspection Procedures Leaflet AL/7-1

The Methods of Checking Flying Instruments for Correct Functioning, the Inspection of Instruments and Instrument Installation in Aeroplanes, and Methods of Making Check Calibration

After a list has been made of instruments, such as altimeters, airspeed indicators, turn indicators, etc., a short description of each should be given. The method of operation should be stated and the main points added

which require attention to ensure satisfactory operation during installation. Consider, for instance, what effect a blocked filter would have on an air-driven turn indicator.

An ex-service applicant for an "A" licence should bear in mind that the civil procedure differs from the service procedure in that the "A" licensed engineer is responsible for checking the flying instruments when installed, and should, therefore, know the method of checking for accuracy, with approximate limits of error allowed, possible defects and symptoms. This leads to notes on portable calibrators and methods of using them.

The Inspection of Electrical Installations in Aeroplanes and Testing for Correct Functioning and Condition

This part of the syllabus is recommended as a subject for very strict self-examination. Quite commonly much of such work is carried out on aircraft by specialist electricians, and a particular effort may therefore be necessary to secure practical experience and knowledge of this subject, especially in the case of the ex-service applicant (see previous item).

The duties of an "A" licensed engineer include inspection of such work as:

(i) Any testing which may be necessary for the correct functioning and condition of the electrical services when assembling an aircraft or changing a component, and the repair and rectification of minor faults. This involves knowledge of tests for continuity and insulation and correct functioning, including the methods and apparatus used and the results desired.

(ii) The bonding system on an aircraft, the methods of testing it (with apparatus used) and the results desired.

(iii) Care and maintenance of the aircraft batteries. The candidate should be familiar with the methods and means of carrying out checks for specific gravity of the electrolyte, voltage, capacity and general condition, and the results desired.

In all the above, it is necessary to be familiar with the minimum standard acceptable, and the results usually obtained.

All the points mentioned above should be covered by adequate knowledge and practical experience.

The Inspection of Undercarriage Shock-Absorbing Legs, Brakes, Wheels and Tyres

(i) The Inspection of Undercarriage Shock-Absorbing Legs

A careful study should be made of the types fitted to the aircraft for which examination is being undertaken, such as: air; air/oil; rubber; steel spring; "liquid spring", etc.

Notes should be made on the principle and operation of each type, together with maintenance and checking required, possible defects, points where wear may occur, and replacements which may be made.

(ii) Brakes, Wheels and Tyres

Make a study of typical examples of each of the types of braking system—pneumatic, hydraulic and electric—and practise sketching the layout of each type of system, with components, pressures, valves, etc., and also the cooling systems now used on larger aircraft.

List the typical defects commonly to be found in tyres—cuts, bulging, creep, etc.—and note also the correct air pressures to be maintained and the repairs permitted. Become familiar with the limits of defects before rejection of the tyre becomes necessary.

The Principles of Operation of Retractable Undercarriage and Flap Operating Systems and Inspection of these Systems where Applicable

Make notes on the general principles involved; become familiar with the types of actuating system employed in the aircraft being considered and the component parts generally found in such systems. Then list methods of testing and checking the systems after assembly with the main aircraft structure, defects commonly encountered, their symptoms, and methods of rectification. Attempting to draw a diagram of a typical system is a useful check on knowledge of both principles and practice in this subject.

Finally, give some thought to the various emergency

systems which are provided in case of failure of the normal system of lowering the undercarriage. These may rely upon compressed air, reserve fluid and hand pump, cordite cartridges, elastic cords, electrical power or gravity. How are these emergency systems tested, maintained and inspected?

Where Applicable, General Principles of Operation of the Particular Type of Automatic Pilot Installed in the Aeroplane

This is self-explanatory and the relevant manufacturers' handbooks should be studied.

Where Applicable, Methods of Coupling the Automatic Pilot System to the Aircraft Flying Controls. Tests to Ensure that the Automatic Pilot can be Immediately Disengaged and/or Over-Controlled in any Emergency

This, like the preceding item is, self-explanatory and calls for study of the appropriate procedures.

Where Applicable, the Maintenance and Periodical Inspections Necessary to Ensure Correct Operation and Functioning of Automatic Pilot Installations

Although the aircraft engineer licensed in the appropriate rating of Category "X" is responsible for the Automatic Pilot Installation, the aircraft engineer licensed in Category "A" is responsible for the daily maintenance and periodical inspection as well as for functioning checks as specified in the respective makers' instructions. Study of the relevant makers' handbooks is therefore called for.

Where, subsequent to the written examination, an oral examination is required by the A.R.B., applicants may be required to answer further questions in respect of the subjects detailed in the foregoing items and in all cases shall demonstrate in this examination:—

Practical Knowledge of Inspection, and Familiarity with the Use of Measuring Instruments and the Interpretation of Drawings

(i) Practical Knowledge of Inspection

This item of the syllabus is very wide in scope and the questions are specially directed towards ascertaining the applicant's practical knowledge as opposed to his text-book knowledge. For example, in the written examination an applicant may have described a particular repair or process in rather a theoretical manner, or he may have omitted some important detail; in the oral examination he may be asked to amplify his written answer. It is therefore advantageous to obtain practice by describing orally as many processes, methods of flaw detection, repairs, adjustment, checks, etc., as possible.

(ii) Use of Measuring Instruments and the Interpretation of Drawings

This item covers the practical use of the micrometer, vernier and other gauges. Familiarity with their use is essential.

Practice in the interpretation of drawings is easily obtained by studying those given in manuals and handbooks, and at the same time following the printed explanations.

It should be appreciated that all that has been written dealing with the syllabus for Category "A" has been in the nature of an illustration of a method of tackling it. It should not be assumed that the examples given here are complete and sufficient, as the examples required will depend on a candidate's knowledge of any section. Should the aircraft in respect of which the licence is required contain other systems, such as air-conditioning systems, de-icing systems or power-operated controls, the same methods of approach will be helpful, although it is recommended that a course of instruction on such types of aircraft be obtained before making application for the licence.

Studying the Syllabus for Aircraft Maintenance Engineer's Licence Category "C" Examination

In the written examination, applicants will be required to answer questions to show their knowledge of the following subjects according to the type or types for which they have been accepted.

GENERAL

The Air Navigation Order and Regulations and the A.R.B. Requirements and Recommendations Appropriate to an Aircraft Maintenance Engineer Licensed in Category "C"

Practical Arithmetical Calculations Involving Vulgar and Decimal Fractions, Percentages and Mensuration

(Items 1 and 2 of the Syllabus are the same as for Category "A" examinations.)

The Preparation of a Brief Report, Illustrated by Sketches if Necessary, Describing the Replacements Required in the Event of Damage, Defect or Wear

Methods of Inspection for Defects, Rectification, Clearances and Tolerances for Wear and Distortion

(i) Methods of Inspection for Defects

Check your knowledge of how each of the following should be inspected:— pistons, gudgeon pins, connecting rods (in position), small end locations in connecting rod and in piston, valves, valve springs, piston rings.

Make a comprehensive list of the parts which come within the scope of a "C" licence engineer, then add notes on likely defects, expressed in broad terms which may help you to remember the defects associated with particular parts. For example, cracks, fractures, wear and ovality on inside diameters, wear and ovality on outside diameters, deterioration of protective treatments and finishes, distortion or loss of physical properties due to overheating, deterioration in qualities of springs, deterioration of mating faces or seating.

Make sure you can answer the following questions:—

What type of gauge should be used for measuring the ovality of, say, piston bosses? Find the correct gauge to use, and ascertain the reason for its size and the importance of its shape.

Which parts are most likely to need replacements? Which parts are always scrapped when worn and new parts fitted? Why?

(ii) Clearance and Tolerances for Wear and Distortion

After consideration of the defects likely to be encountered, note approximate tolerances and limits permissible for wear and distortion. Such details are best not committed to memory but an engineer should know the correct sources from which to obtain the exact figures.

Methods of Rectification of Defects, Inspection During and After Re-Assembly

(i) Methods of Rectification of Defects

Making use of the list of likely defects compiled under the previous item, set down against each the rectification necessary.

(ii) Inspection During and After Re-Assembly

Having ascertained the methods of rectifying all defects, it now becomes necessary to ensure correct inspection during and after re-assembly; for example, it is of no use ensuring that a cylinder is correctly secured if the gudgeon pin inside it has not been correctly lubricated and locked. Make a list of the order of assembly and note against this list the inspection checks to be carried out.

Inspection and Checks on Complete Installation and Systems, as Required after Engine Installation

The applicant should visualise an engine being installed in an aircraft; taking as an example an air-cooled radial engine with a single speed supercharger and a V.P. propeller, a list of checks should be made on the following lines:—

Priming	mag. drop
starting	boost settings
oil pressure	maximum R.P.M.
fuel pressure	power
oil temperature	slow running mixture
mag. switches	slow running R.P.M.
V.P. propeller	slow running cut-out
cylinder head temperature	

It should be clearly understood that the checks must include those applicable to the various systems, fuel, oil, etc., and that they should be in their correct order.

Inspection of the various systems is covered in Civil Aircraft Inspection Procedures.

Notes should be made against each item showing the purpose of the check, any reasons which may exist for making the checks in a particular order, and the results which may be obtained, both good and bad.

Make certain that the reasons for recommendations are understood; as a test, try to answer the following questions:—

Why is it better to check mag. drop with the propeller on its fine pitch stops? How can it be ensured that this is so? Why is a special check for power necessary? What is the manufacturer's recommendation for this check? Why are maximum boost and R.P.M. on modern large engines not reliable as indications that the engine is giving its usual power?

Installations equipped with a constant speed propeller and a boost control can present difficult problems. Consider the following example:—

On four-engined aircraft, a sheared fuel pump drive may cause a failure of one engine which could be overlooked for some time. After failure of the engine, the oil pressure, boost pressure and R.P.M. would remain normal: Why? Three other instruments would indicate something wrong after a time: Which would they be and how would they indicate the trouble? Test your ability to answer these questions.

Having made preliminary notes on these lines, become familiar with results obtained on the engine or engines for which examination is being undertaken, taking into account the variations permissible. Consider also possible defects shown up during the run, methods of checking for possible causes, and rectification of them. Ground testing modern engines calls for different techniques to be employed in relation to the various types of engines. The A.R.B. have, therefore, requested all engine manufacturers to make this information available by issuing "Service Instructions" which explain the technique to be employed and the precautions which must be observed when ground testing their engines.

The Methods of Checking Engine Instruments for Correct Functioning, the Inspection of Engine Instruments and Instrument installation in Aeroplanes, and Methods of Making Check Calibrations

Make a list of instruments thus:— R.P.M. indicator, oil pressure gauge, oil temperature gauge, etc. Notes should be made giving a brief description of the principles of operation of each, the units and range of the graduations and the advantages and disadvantages of the different types in use.

Using the list as a basis, deal with the checking of each instrument for accuracy when installed, with approximate limits of error allowed, and possible defects and symptoms. Add also notes on portable calibrators and the methods of using them.

It should be borne in mind by the ex-service applicant for a "C" licence that civil procedure differs from service procedure in that the "C" licensed engineer is responsible for the serviceability and functioning of the engine instruments when installed.

Testing and Tuning During Ground Running in Accordance with the Manufacturer's Recommended Procedure, including Diagnosis of all Types of Running Faults

(i) Testing and Tuning During Ground Running in Accordance with the Manufacturer's Recommended Procedure

This obviously calls for detailed study of the relevant portions of the maker's "Maintenance Manual", in conjunction with actual practical experience. Practice should be obtained in condensing the vital information given and in preparing a check list. General guidance on the ground testing of installed engines is given in Leaflet EL/3-5 of Civil Aircraft Inspection Procedures.

(ii) Diagnosis of All Types of Running Faults

The best method of dealing with this will be to make a list of all the usual defects—rough running, overheating, flames from exhaust, carburation and ignition faults, etc.—and against these set down the likely causes which would give rise to such defects.

Preparing Engines for Initial Installation and Inhibiting After Removal; Inspection During Daily Maintenance and Periodical Servicing

(i) Preparing Engines for Initial Installation and Inhibiting After Removal

This calls for a knowledge of the method of inhibiting an engine for storage purposes, etc., and also with the preparation of an engine for installation after storage and the consequent removal of the inhibitor, etc. Again guidance will be found in the maker's handbook and the applicant should extract the important points and summarise them into a concise description.

(ii) Inspection During Daily Maintenance and Periodical Servicing

This can be expanded for study on these lines: knowledge is required of the periodical maintenance and inspection checks carried out on the engine installation; the extent of the various inspections which are called for by the maintenance schedules, and the certification necessary; the cleaning and greasing necessary at regular intervals, the method of carrying out engine runs and final inspections before flight.

Make a list of the external parts of the engine installation to be studied. This is best done while viewing an actual installation, or a set of good photographs. Afterwards make notes of the inspection checks which are required.

For example, an air-cooled radial engine should be tackled thus:— sub-divide the engine installation in a simple way into the three sections, front, cylinders and crankcase, and rear.

Then, under each sub-division heading list all main components, like this:

Front Section	*Cylinder Section*	*Rear Section*
Sump Filter	Cylinders	Magnetos
Propeller	Cylinder heads	Carburettor
Exhaust system	Rocker gear	Pipe lines
Pipe lines	Exhaust stubs	Filters
Reduction gear	Induction pipes	Pumps
etc.	Sparking plugs	Compressors
	Ignition harness	Starters
	etc.	Controls, etc.

Now expand this bare list to include main points for which each item will be inspected, possible defects, how they should be detected and rectified and any testing apparatus which may be used.

(There is a reason why the sump filter is specified as the first item to be inspected in the bare sample list above. What is the reason?)

Include in this section notes on work and adjustments which may be necessary when installing the engine, including fitting starters, pumps, propellers, magnetos, etc., and checking them for correct assembly and functioning.

After making notes on the inspection procedure, carry on to the engine run-up. With modern engines, especially in multi-engined aircraft, even experienced personnel find it advisable to have a list of checks prepared beforehand, so that nothing is missed during the run. Most engines cannot be run repeatedly or for long periods on the ground, and the checks must be made systematically to reduce ground-running time to a minimum.

Where Applicable, the Assembly of Variable-Pitch Propellers Dismantled for Ease of Transport, Assembly of Propeller to Engine, Inspection of Damage to Propellers, Permissible Limits and Methods of Rectification

A "C" licensed engineer is expected to be competent to certify the satisfactory assembly (in addition to the correct attachment to and functioning when fitted to an engine) of a propeller which has been received with blades dismantled for ease of transport. Consequently a knowledge of the construction of typical propellers and the rectifications which a "C" licensed engineer is permitted to certify is essential.

Where Applicable, the Principles of Operation of Variable-Pitch Propellers and Controlling Devices; Inspection of Assembly and Functioning; Ground Testing and Rectification of Defects

Notes should be made on the principles of operation of variable-pitch propellers, including constant speed units,

followed by further notes on possible defects, adjustments, and rectifications which may be necessary. Feathering and unfeathering systems and checks should be covered.

PISTON ENGINES

The Principles of Operation of Piston Engines and the General Construction of the Current Type or Types of Engine for which the Applicant is Accepted

The candidate should, for example, have a satisfactory knowledge of the following:—

four stroke cycle
magnetos—different types
firing orders
advance and retard
poppet and sleeve valves
timing diagram
valve overlap

and also:—

1 the reason why the ignition timing is sometimes automatically retarded at wide throttle openings;
2 the relation of magneto speed to crankshaft speed;
3 the relation of cam gear speed to crankshaft speed.

Construction Details of Parts the Rectification of which may be Certified by the Holder of a Licence in Category "C"

It is useful to have some idea of the construction, materials, treatments, surface finishes, protections, and methods used in securing all the parts of typical engines in current use. It is essential, however, to have a thorough knowledge of these matters in relation to all the parts which come within the "C" licensed engineer's scope for rectification or adjustment. The latter include cylinders, pistons, cylinder heads, valves, springs, valve operating gear, carburettors, injectors, and automatic mixture and throttle controls.

Typical Running Faults and Defects Calling for Partial Overhaul or Other Rectification which may be Certified by the Holder of a Licence in Category "C"

This item should be studied in conjunction with the item of the syllabus dealing with diagnosis of running faults. This list formed under the latter item should be expanded to show, after diagnosis, the rectification or partial overhaul necessary.

The Principles, Arrangement and Inspection of the Complete Fuel, Oil (and Coolant, where Applicable) Systems, and Tests for Functioning and Defects and Methods of Rectification

The candidate should practise sketching the layouts of various systems. Below each sketch lists should be made of the different functioning tests and of typical defects with the rectifications necessary.

Inspection of Ignition Systems for Condition, Correct Installation, Timing and Functioning, and Tests for Defects and Methods of Rectification

The "C" licensed engineer is responsible for the inspection of ignition systems for condition, functioning, continuity and insulation (See Chapter III).

The applicant for a "C" licence must make himself familiar with the general principles of ignition systems, their correct installation, condition and functioning. He must also have practical knowledge of the tests for defects, including continuity and insulation tests and of the methods of rectification of defects found.

The Principles of Operation of Carburettors and/or Injectors: Inspection of Carburettors and/or Injectors, Controls and Induction Systems: Tests for Functioning and Defects

The relevant manufacturers' manuals should be studied and sketches made (with explanatory notes) to show the principles of operation. Lists of defects should also be made, with symptoms which would lead to their diagnosis and the rectification necessary.

Where Applicable, the Inspection of Fixed-Pitch Propellers and Checks During Assembly to Engine

Notes should be compiled from the various manufacturers' manuals. Include also notes on the limits of various defects and methods of rectification. Make sure that you can answer the following question. What are the factors governing the fitting of a propeller to any particular engine ?

Where Applicable, the Principles of Supercharging and the Operation of Boost Controls; Inspection for Correct Assembly, Adjustment and Functioning

Firstly, the definitions of power, R.P.M. and power at altitude given in British Civil Airworthiness Requirements should be memorised.

To understand this subject, some study of the characteristics of the atmosphere is necessary, particularly with regard to the effect of changes in altitude and temperature on density and pressure.

The next step is to consider the mechanical means used to supercharge an engine, and the function of various parts. Consider this in relation to current practice as exemplified in different types of engines under review. The effect on engine output of power absorption by the blower, and of the temperature rise across it, should be noted.

Finally, the comparison of power at sea level and at altitude for the same R.P.M. and boost should be considered in conjunction with the notes on carburettors and their automatic controls prepared for a previous item in the syllabus.

GAS TURBINE ENGINES

The Principles of Operation of Gas Turbine Engines and the General Construction of the Current Type or Types of Engine for which the Applicant is Accepted

Candidates should, for example, have a satisfactory knowledge of the following:—

Theoretical gas flow through the engine.

Effect of altitude, forward speed, temperature and density on power and fuel consumption.

Principle of operation of a gas turbine engine.

Comparison of axial and centrifugal compressors.

The Various Terms used in the Construction of Turbine Engines and the Functioning of Each Component Part of the Engine

It is necessary to have some knowledge of the construction, and methods used in the securing of various parts, of typical engines in current use. It would be advisable to list each part, with its construction, methods of attachment, etc. The principle components are as follows:—

Static assembly: compressor casings; combustion chambers; stator blade assembly; exhaust shrouds; exhaust cone; propelling nozzle.

Rotating assembly: compressor assembly; turbine(s) and blading; main drive shaft and associated bearings.

Procedure for the Partial Dismantling and Re-Assembly of the Engine to Permit Inspection and Rectification which may be Certified by an Engineer Licensed in Category "C"

It is essential to have a thorough knowledge of the construction, materials, treatments, surface finishes, protections, etc., in current use in relation to all the parts which come within the "C" licensed engineer's scope for inspection, rectification or adjustment. These include the combustion chamber, all accessories (e.g. generators, hydraulic pumps, external gearboxes), the sheet metal work of exhaust cones, jet extension pipes and fire guarding and damage to the rotating assembly, turbine blades, etc.

Construction, Functioning and Maintenance (Including Adjustments) of all Systems and Ancillary Devices Necessary for the Operation of the Engine

This necessitates a thorough knowledge of the engine oil and fuel systems and components, bearing cooling systems, compressor spill valve systems, etc., and, where applicable, reduction gears, propeller shafts and propellers.

The Principles of Operation of Fuel Systems and Controls, Inspection of Complete Fuel Systems and Controls and Tests for Functioning and Defects

The candidate should practise sketching the layouts of various systems. Below each sketch, lists should be made of the different functioning tests and of typical defects with the rectifications necessary.

Inspection of Ignition Systems for Correct Installation, Condition and Functioning and Tests for Defects and Methods of Rectification

The "C" licensed engineer is responsible for the inspection of ignition systems for condition, functioning, continuity and insulation, and should therefore make himself familiar with the general principles of ignition systems used for starting turbine engines, their correct installation, condition and functioning. He must also have practical knowledge of the tests for defects, including continuity and insulation tests and of the methods of rectification of defects.

Principles, Arrangements and Inspection of Starter Panel Systems. Testing for Functioning, Defects and Methods of Rectification

Candidates should ensure a complete knowledge of the significance and use of the starter panel items, their functioning, etc.

Construction, Functioning and Maintenance of the Complete Starting System

Candidates should have a knowledge of the construction and functioning of all items in the system and be capable of sketching the system and giving function and installation checks, etc., for the appropriate items.

Knowledge of Safety Precautions During Ground Running, Parking and Storage, and Means of Protection of Breakdown Points of Fuel Systems

Candidates should bear in mind important points such as the following:—

Safety clearance behind jet pipes for buildings, fuel installations, etc.; wind direction; guards, fire-fighting apparatus; intake and jet pipe blanks; methods of inhibiting engines and engine fuel systems, etc.

Where, subsequent to the written examination, an oral examination is required by the A.R.B., applicants may be required to answer further questions in respect of the subjects detailed in the foregoing items and in all cases shall demonstrate in this examination:—

Practical Knowledge of Inspection and Familiarity with the Use of Measuring Instruments and the Interpretation of Drawings

(i) Practical Knowledge of Inspection

This item of the syllabus is very wide in scope and the questions are specially directed towards ascertaining the applicant's practical knowledge as opposed to his text-book knowledge. For example, in the written examination an applicant may have described a particular procedure in rather a theoretical manner, or he may have omitted some important detail; in the oral examination, he may be asked to amplify his written answer. It is therefore advantageous to obtain practice by describing orally as many procedures, rectifications, adjustments, checks, etc., as possible.

(ii) The Use of Measuring Instruments and the Interpretation of Drawings

This item covers the practical use of the micrometer, vernier and other gauges. Familiarity with their use is essential.

Practice in the interpretation of drawings is easily obtained by studying those given in the different manuals and handbooks, and at the same time following the printed explanations.

It should be appreciated that all that has been written dealing with the syllabus for Category "C" has been in the nature of an illustration of a method of tackling it. It should not be assumed that the examples given here are complete and sufficient, as the examples required will depend on a candidate's knowledge of any section. Wherever possible a course of instruction on the engine type for which the licence is required is recommended.

Chapter VII

SOME FACTS ABOUT THE SOCIETY AND ITS EXAMINATIONS

The Society

The Society of Licensed Aircraft Engineers and Technologists was founded in May, 1944, as the Society of Licensed Aircraft Engineers, to function as a professional Society for Aircraft Engineers.

After the Licensing of Aircraft Maintenance Engineers was introduced in 1919 as a means of simplifying the validation of the "Daily Certificate of Safety for Flight" required by the Air Navigation Act, efforts had been made between 1919 and 1939 to form a Society of Licensed Aircraft Engineers, but these were unsuccessful.

At the time of the Society's formation in 1944 it was known that the Air Registration Board would welcome a well organised and responsible body, providing it represented a large number of engineers and that there were, among them, those with seniority and experience. It has always been the aim of the Society to provide such representation and it enjoys cordial relations with the A.R.B.

In 1962, with the changing pattern in the aircraft industry and the increasing complexity of modern aircraft, the Society sought to widen its membership by the introduction of the words "and Technologists" to its title, thus making it possible for specialists and technologists in the Industry to become members.

The membership now includes Chief Engineers, Managers, Development, Planning and Maintenance Engineers and Technicians representative of the many and varied aspects of aeronautical engineering in the widest possible sense; Consultants, Lecturers, and Aviation Insurance Surveyors.

The Society's Patron is Marshal of the Royal Air Force Lord Douglas of Kirtleside. Every two years a President is elected from among the members who hold positions of responsibility and esteem in the Industry.

The Society is governed by a General Council, which delegates powers to the many panels and Committees which are needed to provide for the services and facilities offered by the Society to its members.

These subsidiary bodies include a Finance and General Purposes Committee, a Central Examining Authority, a Lectures Committee, an Education and Students Panel, a Licensing and Legislation Panel, an Overseas Liaison Committee and a Publications Panel, to mention but a few.

The Society maintains a permanent Secretariat, the chief executive of which is the Secretary-General, who is responsible to the Council of the Society for the efficiency of its organisation.

The Central Examining Authority of the Society has autonomous powers and has for many years laid down the conditions, and administered the arrangements for, the Society's Associate Membership Examinations. The Authority has, among its membership, many eminent and highly respected figures in the Industry, and as a result of its insistence on the maintenance of high standards for the Examination, the Society's Associate Membership qualification, by examination, has gained considerable recognition; by the Air Registration Board, by The British Overseas Airways Corporation, The British European Airways Corporation and British United Airways, and by other authoritative bodies.

The information relating to the Society's Examinations should prove of considerable interest to those who wish to obtain a professional qualification that will give entry into, and advancement in, various grades of aeronautical engineering.

The Purpose of the Examinations

The Society sets its own examinations. They are used primarily to determine whether an applicant has sufficient technical knowledge to be admitted to either Associateship or Associate Membership.

This is not the only criterion for membership but it is nevertheless a most important one—and the Examinations represent the only formal occasion on which the Society can hope to obtain clear proof of sound professional knowledge.

The examinations are designed not as a handicap competition between the candidate and the examiners but as a series of questions which will allow the candidate to show himself to the best possible advantage.

In addition, by publishing specimen copies of past examination papers, the Society enables any employer or outside organisation to appreciate the technical level at which the Society accepts its members. The Society thus publicly declares its standards and the qualities demanded of its Members through the medium of its examination Regulations and Syllabus. In declaring its standards, it also sets forth its aims, by defining the knowledge and experience which must be held by its Membership.

The standards of the examination are difficult to define. A mere reading of the Syllabus is not in itself sufficient. The only way in which to appreciate the value of the Syllabus is to read copies of past examination papers to try and appreciate the examiners' aims in each question and, best of all, to attempt to answer the questions satisfactorily on a trial basis.

In the main, the Associate Membership examination is intended for the Engineer or Technologist who is concerned with the maintenance, rather than the design, of complex civil and military aircraft.

The Rules of the Society do not permit exemption for holders of Aircraft Maintenance Engineers' Licences. The Society believes that the scope of its own examination in some respects goes beyond that of the Licence examination. This does not detract from the realistic and necessary requirements of the A.R.B. It simply indicates that Corporate Membership of the Society is something to be achieved only by engineers capable of extending their knowledge beyond the minimum requirements specified by the A.R.B. The fact that the full examination continues for two days is an indication that the Society requires a particularly thorough demonstration of a candidate's knowledge.

The Form of the Examination

There are two groups of papers, each occupying one day of the examination.

Each group consists of two papers, some of which are split for convenience into two parts.

Group I, on the first day, consists of Paper I, on General Aviation Knowledge, and Paper II, which is in two parts. Both parts are concerned with Basic Science and Engineering, the former (IIA) relating to Mechanical subjects and the latter (IIB) to Electronic subjects.

A candidate should be sufficiently interested in his job to keep abreast of the aviation technical press and should also make use of his local library facilities. If sufficiently well-read he should have little difficulty with Paper I, provided that he has also sufficient practical experience to deal with the more specific industrial questions.

The questions in Paper I are terse and to the point. This is because the wide range of subject matter must be relatively lightly treated in order to give a wide coverage which is fair to all. Specialisation comes later in the examination.

Paper II is concerned with the applied science and technology of aircraft, their propulsion and other systems. For convenience, the two broad fields of Mechanical and Electronic engineering are considered. It is largely possible to achieve a satisfactory level in Group I by means of academic training and appropriate study. The requirements of practical experience are not yet involved in the subject matter of the examination.

Success in Group I of the Associate Membership examination entitles a candidate to apply for direct entry in the Associate Grade of Membership.

Group II, on the second day, is more exacting and consists of Paper III, Report Writing, and Paper IV, a "Specialist" subject. Paper III demands that the Corporate Members should be able to communicate their technical knowledge and opinions.

The engineer who aspires to Supervision and Management must be able to convey his ideas on paper and to encourage action in seniors, equals and subordinates alike. Furthermore, he may be required to convince non-technical colleagues of the best decisions relating to technical matters. A failure on the part of the engineer to communicate his findings could in certain circumstances result in unnecessary hazards to the safety of an aircraft.

Many clear, balanced and even witty books are available on the subject of effective report writing. The Society has also recorded its own views on this subject. The latter are contained in the December, 1959, issue of the Society's Journal, together with a useful list of relevant books. Candidates studying for Paper III should take these views seriously. They have stood the test of a period when aviation has been changing fast and they will probably do so for a long time to come.

Report writing is a subject where mere reading is not enough; practice is essential. Practice and more practice, coupled with self-criticism and the constructive criticism of friends and associates. Above all, the writer must ask himself: "Who will read what I write and what do I want them to do or think as a result of reading it?" If this question can be clearly answered, then the writing of the report will become much easier.

Like Paper III, Paper IV (the "Specialist" subject) cannot be tackled successfully by a candidate who relies solely on information from books and manuals.

Essentially, the examiners are asking the candidate: "How would *you* diagnose this fault? How would *you* sequence the task so as to arrive at a swift and accurate conclusion? What is *your* choice of tools and equipment?"

The answers to questions such as these are not easily found in books or manuals.

The engineer or technologist who has worked in this particular field should, however, be able to relate his experience to his practical and theoretical knowledge. In relating them in a systematic way, he should be able to do all that the examiner expects of him.

Finally, some words of advice which could well be printed at the top of each answer sheet:

Do allow a minute or two for reading the question carefully and for deciding what to write and how to write it. The examiners have allowed time for this, so why not use it?

Do try to write and sketch clearly. The examiners are painstaking and fair, but they do not wish to waste time deciphering untidy work.

Don't try to hoodwink the examiners. They outnumber you and have much more time to check up your answers than you may think.

Do take the trouble to prepare and revise for each paper. Incomplete knowledge and lack of care are possibly more dangerous in the aircraft industry than anywhere else. For this reason, the Society does not believe in low pass marks which might enable irresponsible men to hold responsible positions.

Appendix

PUBLICATIONS

Titles

As far as possible the most important regulations applicable to Licensed Engineers are summarised in this booklet, but applicants are advised to supplement this information by a study of the following:—

1 *The Air Navigation Order*, 1960, *as amended*

2 *British Civil Airworthiness Requirements, Sections A and L*

B.C.A.R., as the title implies, constitutes the basis on which recommendations will be made by the A.R.B. to the Minister of Aviation. Section A deals with General Information and Procedure, Section L with Licensing.

3 *Civil Aircraft Inspection Procedures*

Civil Aircraft Inspection Procedures deal with the various aspects of the construction, overhaul and maintenance of civil aircraft. Recommended practices related to workshop methods, processes and servicing, and information considered essential to the proper understanding of the Inspection Procedures are also included. There are eight sections—Basic, Airframe, Engine, Propeller, Power Plant, Electrical Equipment, Miscellaneous and Radio. The Inspection Procedures are under constant review.

4 *A.R.B. Notices*

A.R.B. Notices are replacing Notices to Licensed Aircraft Engineers and to Owners of Civil Aircraft so that the information contained therein may be given wider distribution. One copy of each A.R.B. Notice is issued free of charge to each owner of Civil Aircraft on the British Register, each Licensed Aircraft Engineer and each Organisation Approved under the Air Navigation Order. Thereafter one copy each of all new and revised Notices will be issued during the period of validity of the certificate of airworthiness, licence or approval, as appropriate.

5 *A.R.B. Handbook No.* 1

The requirements of the Air Navigation Order and British Civil Airworthiness Requirements with particular reference to the issue and renewal of certificates of airworthiness and the maintenance of civil aircraft have been carefully summarised in this handbook, and it is therefore an invaluable reference book for all concerned with the maintenance and operation of civil aircraft.

6 *Journal of the Society of Licensed Aircraft Engineers and Technologists*

This is a monthly publication, issued free to members, which was first published in January, 1945. Subscription rates to non-members £3 0s. 0d. per annum (twelve issues).

7 *An Engineer's Guide to Technical Report Writing*

A treatise written by the Chairman of the Society's Central Examining Authority, Air Commodore Sir Vernon Brown, C.B., O.B.E., M.A., F.R.Ae.S., Hon.M.S.L.A.E.T. It is recommended to all concerned with the writing of technical reports, particularly for examination purposes. Price 2/6d.

8 *Regulations and Syllabus of the Examinations of the S.L.A.E.T.*

Obtained gratis on request to the Secretariat.

9 *Constitution, Rules and Regulations of the S.L.A.E.T.*

Supplied to all members of the Society.

NOTE: Copies of all A.R.B. Publications are held in the Technical Library of the S.L.A.E.T. and may be consulted by members in situ.

Publishers

Item 1 may be obtained from Her Majesty's Stationery Office, P.O. Box 569, London, S.E.1.

Items 2 to 5 may be obtained from the Secretary, Air Registration Board, Greville House, 37 Gratton Road, Cheltenham, Glos., from whom a full description of all A.R.B. publications may also be obtained.

Items 6 to 9 may be obtained from the Secretary-General, Society of Licensed Aircraft Engineers and Technologists, Mark House, 153 London Road, Kingston-upon-Thames, Surrey.